

Ameren Illinois Rate Zone I  
Section 285.5120  
Schedule E-7: Load Research Results and Supporting Materials

The load research was based on a new load research sample which was fully implemented in January 2014. The sample was designed for the post 2006 delivery service rates.

**Schedule E-7(a): Load Research Results**

- 1) *Monthly class and Illinois jurisdictional loads at the time of the system coincident peaks, along with the date and time of such peak;*

Please see schedule E-7(a)(1)

- 2) *The monthly maximum non-coincident peak demands for each customer class, along with the date and time of each peak for each customer class.*

Please see schedule E-7(a)(2)

- 3) *Class and Jurisdictional Load Factors; and*

Please see schedule E-7(a)(3)

- 4) *The statistical confidence level achieved for each set of load data developed.*

The original samples were designed for an accuracy of +/- 10% at the 90% confidence level at the time of the annual system peak. Due to over sampling and near census analysis for several classes, the resulting precisions in many classes were well below the accuracy design.

**Schedule E-7(b): Supporting Materials**

- 1) *The time period over which the data was collected:*

The data were collected for calendar year 2014.

- 2) *A full description of the statistical methods used by the Utility to derive load research results, including accuracies and confidence levels its load research samples were designed to achieve; and*

The goal of the load research sample design is to design a sample of customers from each applicable customer class that:

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- 1) Provides an accurate representation of the load characteristics of each customer class.
- 2) Provide estimated customer loads with a relative accuracy of +/- 10% at a 90% confidence level.

To achieve these goals, the following sample design steps are followed for each applicable customer class:

- 1) Selection of stratification variable(s)
- 2) Determination of number of strata required for each class
- 3) Computation of strata boundaries
- 4) Calculation of sample size

Step 1- Selection of Stratification variable

Stratified sampling is a technique used to reduce variance when two or more different subgroups of a population exhibit different characteristics. The population is separated into non-overlapping groups called strata. The first step in the stratification procedure involves selection of stratification variable on which to divide the population. The stratification variable must be one which shows a high correlation to the variable of interest (usually system or class peak demand).

The most common stratification variables in use include either non-coincident demands or energy usage for a selected historic time period, usually ranging from one month to a year.

Step 2 – Determination of number of strata required for each class

The number of strata is determined by calculating the coefficient of variation of the sampling distribution for test designs with different number of strata. The coefficient of variation is equal to the standard error of the estimate divided by the mean. The coefficient of variation declines as the number of strata increases, but at a diminishing rate. The point at which the coefficient of variation decreases very little as another stratum is added indicates the number of strata needed.

Step 3 – Computation of Stratum Boundaries

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Strata boundaries are designed such that the overall population weighted variance is minimized. The strata boundaries are calculated using a statistical technique called Dalenius-Hodges.

Step 4 – Calculation of sample size

The accuracy of a sample result depends upon the sample size and the degree of variability of in the population itself. Sample size is:

1. Directly proportional to an estimate of the variance of the population,
2. Inversely proportional to the tolerable error (e.g. 10% relative accuracy at the annual system peak), and
3. Directly proportional to the square of the degree of confidence desired.

In most cases Ameren's sample sizes were calculated to yield a relative accuracy of +/- 10% at confidence level of 90%. As previously mentioned the samples are primarily stratified random samples based on the Dalenius-Hodges variance procedure and the Neyman allocation was used to distribute the meters among the strata.

- 3) *A full explanation of the usage strata into which customers in the utility's load research sample is distributed. For each of these usage stratum, the utility must provide the following:*

A combined ratio estimator was used to expand the sample data to the population. The combined ratio estimator utilizes the strata weights as defined in the sample design in conjunction with the kw/kwh ratio to calculate total parameter estimates. This technique produces demand estimates for the class; it does not produce stratum-level demand estimates. However, the total demands are calculated based on the weighed strata kw/kwh ratio and the total energy for the month.

Residential Delivery Service (DS1):

The residential delivery service sample is a stratified two dimensional random sample based on Summer kWh and Winter/Shoulder Ratio. The sample has four strata as follows:

- Strata 1: 0-1300 kwh summer\*, 0-1.6 winter/shoulder ratio\*
- Strata 2: 0-1300 kwh summer\*, over 1.6 winter/shoulder ratio\*
- Strata 3: over 1300 kwh summer\*, 0-1.6 winter/shoulder ratio\*
- Strata 4: over 1300 kwh summer\*, over 1.6 winter/shoulder ratio\*

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- \*Summer = Average Monthly Usage (June 05, July 05, August 05, September 05)
- \*Winter/Shoulder Ratio = (Winter\* Use Per Day)/(Shoulder\* Use Per Day)
- \*Winter = December 05, January 06, February 06
- \*Shoulder = April 05, May 05, October 05, November 05

Small General Delivery Service (DS2):

The small general delivery service sample is a two dimensional random sample based on Summer and Winter kWh. The sample contains four strata as follows:

- Strata 1: 0-5300 kwh summer\*, 0-4500 kwh winter\*
- Strata 2: 0-5300 kwh summer\*, over 4500 kwh winter\*
- Strata 3: over 5300 kwh summer\*, 0-4500 kwh winter\*
- Strata 4: over 5300 kwh summer\*, over 4500 kwh winter\*

- \*Summer = Average Monthly Usage (June 05, July 05, August 05, September 05)
- \*Winter = December 05, January 06, February 06

General Delivery Service (DS3) < 400 kW:

The general delivery service sample is a stratified one dimensional random sample based on load factor. The sample has three strata as follows:

- Strata 1: 0-0.4 Load Factor\*
- Strata 2: 0.4-0.6 Load Factor\*
- Strata 3: over 0.6 Load Factor\*

- \*Load Factor = Average of Monthly Load Factors for March 05-February 06

General Delivery Service (DS3) >= 400 kW:

This sample is nearly 100% stratified by supply voltage:

- Strata 1 - Primary
- Strata 2 - Sub-Transmission
- Strata 3 – Transmission

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Large General Delivery Service (DS4):

This sample is nearly 100% stratified by supply voltage:

Strata 1 - Primary  
Strata 2 - Sub-Transmission  
Strata 3 – Transmission

*A) Identify the number of customers and the customer types (by class) in that particular stratum;*

Please see schedule E-7(b)(3)(A)

*B) Average monthly usage;*

Please see schedule E-7(b)(3)(B)

*C) Average demand in kW at the time of system peak; and*

Please see schedule E-7(b)(3)(C)

*D) Average non-coincident peak demand.*

Please see schedule E-7(b)(3)(D)

*4. An explanation of how the load research sample was derived and justification provided for the appropriateness of the sample used.*

The sample design was derived based on standard load research procedure using stratified random sample which minimizes estimation error and reduces sampling cost.

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Schedule E-7(a)(1): Load Research								
Class Coincident Peak								
Including Distribution Losses								
Hour Beginning	DS1	DS2	DS3	DS3S	DS4	DS4S	DS5	System
1/6/14 6:00 PM	1,016,223	351,029	203,684	7,594	614,457	1,312	23,494	2,217,793
2/11/14 8:00 AM	786,333	355,230	272,364	9,605	754,591	3,584	-	2,181,707
3/2/14 7:00 PM	873,911	280,045	187,185	5,428	614,805	2,991	23,494	1,987,858
4/14/14 8:00 PM	504,820	206,303	179,938	3,191	643,623	1,335	23,494	1,562,703
5/30/14 2:00 PM	481,130	326,038	258,361	2,912	784,103	4,219	-	1,856,763
6/19/14 4:00 PM	821,871	378,038	264,175	2,367	719,080	1,485	-	2,187,015
7/22/14 4:00 PM	837,675	315,535	254,442	2,364	706,275	2,616	-	2,118,907
8/25/14 3:00 PM	940,569	424,106	307,703	3,350	644,007	2,969	-	2,322,704
9/5/14 2:00 PM	789,329	391,149	307,383	3,872	704,201	3,102	-	2,199,036
10/1/14 7:00 PM	478,055	256,643	213,312	11,613	657,995	5,162	23,494	1,646,274
11/17/14 6:00 PM	692,081	268,713	222,415	18,084	673,793	4,858	23,494	1,903,438
12/1/14 6:00 PM	688,076	239,194	213,081	12,819	671,648	4,361	23,494	1,852,671

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Schedule E-7(a)(2): Load Research												
Class Non-Coincident Peak												
Including Distribution Losses												
Hour Beginning	DS1	Hour Beginning	DS2	Hour Beginning	DS3	Hour Beginning	DS3S	Hour Beginning	DS4	Hour Beginning	DS4S	DS5
1/6/14 5:00 PM	1,028,417	1/23/14 10:00 AM	392,535	1/28/14 8:00 AM	262,458	1/22/14 9:00 AM	12,673	1/23/14 7:00 AM	691,678	1/22/14 1:00 PM	6,820	23,494
2/11/14 6:00 AM	890,117	2/7/14 10:00 AM	374,307	2/11/14 8:00 AM	272,364	2/4/14 8:00 AM	10,315	2/13/14 8:00 AM	688,753	2/4/14 11:00 AM	5,384	23,250
3/9/14 2:00 AM	1,049,000	3/3/14 10:00 AM	343,458	3/3/14 8:00 AM	253,141	3/24/14 10:00 AM	10,550	3/18/14 8:00 AM	669,502	3/10/14 3:00 PM	5,703	23,494
4/14/14 7:00 PM	560,523	4/3/14 10:00 AM	278,834	4/28/14 1:00 PM	234,129	4/15/14 10:00 AM	9,330	4/29/14 10:00 AM	676,351	4/15/14 10:00 AM	5,547	23,494
5/26/14 1:00 PM	720,782	5/28/14 11:00 AM	359,233	5/21/14 1:00 PM	277,359	5/1/14 10:00 AM	6,404	5/21/14 1:00 PM	715,643	5/6/14 10:00 AM	4,547	23,250
6/18/14 5:00 PM	848,260	6/19/14 1:00 PM	404,474	6/18/14 1:00 PM	288,639	6/23/14 11:00 AM	4,502	6/26/14 8:00 AM	724,726	6/4/14 1:00 PM	4,867	23,250
7/12/14 3:00 PM	879,718	7/22/14 11:00 AM	365,779	7/7/14 1:00 PM	276,332	7/3/14 11:00 AM	4,638	7/23/14 10:00 AM	707,219	7/7/14 9:00 AM	4,687	23,250
8/24/14 4:00 PM	1,057,106	8/25/14 3:00 PM	424,106	8/25/14 1:00 PM	316,758	8/4/14 1:00 PM	4,193	8/26/14 1:00 PM	713,128	8/29/14 11:00 AM	5,708	23,250
9/4/14 5:00 PM	851,244	9/4/14 1:00 PM	411,985	9/5/14 1:00 PM	307,903	9/26/14 2:00 PM	17,998	9/3/14 10:00 AM	719,399	9/27/14 5:00 PM	9,205	23,250
10/31/14 5:00 PM	528,476	10/1/14 12:00 PM	322,460	10/1/14 2:00 PM	260,844	10/20/14 4:00 PM	25,663	10/1/14 1:00 PM	674,250	10/21/14 10:00 AM	10,321	23,494
11/18/14 6:00 PM	693,377	11/18/14 10:00 AM	326,779	11/18/14 8:00 AM	264,745	11/1/14 2:00 PM	25,542	11/19/14 10:00 AM	686,054	10/31/14 12:00 PM	9,741	23,494
12/31/14 5:00 PM	764,340	12/17/14 10:00 AM	312,257	12/1/14 9:00 AM	252,512	12/4/14 10:00 AM	16,617	12/11/14 8:00 AM	673,510	12/10/14 9:00 AM	5,877	23,494

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Schedule E-7(a)(3): Load Research								
Class Load Factors								
Month	DS1	DS2	DS3	DS3S	DS4	DS4S	DS5	System
January-14	65%	68%	68%	77%	85%	49%	59%	78%
February-14	71%	69%	69%	66%	86%	58%	55%	78%
March-14	46%	65%	69%	47%	85%	50%	50%	74%
April-14	59%	70%	71%	40%	85%	52%	44%	82%
May-14	50%	57%	63%	39%	84%	50%	41%	73%
June-14	56%	61%	67%	42%	87%	47%	38%	71%
July-14	54%	59%	69%	40%	87%	44%	39%	71%
August-14	48%	59%	63%	45%	86%	39%	43%	68%
September-14	43%	56%	59%	12%	84%	27%	48%	64%
October-14	63%	60%	64%	34%	85%	44%	53%	79%
November-14	63%	66%	63%	61%	85%	58%	57%	76%
December-14	68%	71%	67%	74%	86%	74%	60%	82%

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Customers								
Month	DS1	DS2	DS3	DS3S	DS4	DS4S	DS5	System
January-14	328,693	55,606	1,363	95	180	8	31,365	417,310
February-14	329,669	55,877	1,355	89	178	8	31,393	418,569
March-14	334,014	56,653	1,379	94	179	8	31,560	423,887
April-14	326,967	55,202	1,355	91	176	8	31,187	414,986
May-14	325,173	55,120	1,445	97	178	8	31,000	413,021
June-14	326,475	55,776	1,415	101	189	9	31,318	415,283
July-14	327,387	55,620	1,397	101	188	9	31,203	415,905
August-14	325,865	55,918	1,399	104	193	9	31,193	414,681
September-14	328,202	56,332	1,412	102	189	9	31,417	417,663
October-14	326,058	55,663	1,381	103	190	9	30,976	414,380
November-14	327,555	57,447	1,402	102	187	9	31,215	417,917
December-14	329,519	57,250	1,411	104	197	9	31,393	419,883

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Average Usage per Customer							
Including Distribution Losses							
Month	DS1	DS2	DS3	DS3S	DS4	DS4S	DS5
January-14	1,502	3,573	97,423	76,262	2,429,660	311,536	326
February-14	1,295	3,106	93,370	51,425	2,224,481	262,606	275
March-14	1,082	2,933	93,814	39,258	2,361,503	266,258	276
April-14	728	2,550	87,734	29,316	2,353,348	261,836	241
May-14	829	2,783	90,230	18,947	2,501,645	210,588	226
June-14	1,057	3,190	98,865	13,322	2,392,471	184,694	205
July-14	1,075	2,866	100,939	13,509	2,434,787	169,746	218
August-14	1,160	3,329	106,548	13,551	2,368,647	183,668	239
September-14	806	2,926	92,733	15,654	2,298,276	197,560	256
October-14	764	2,595	90,243	63,613	2,251,798	379,113	298
November-14	958	2,716	85,432	110,147	2,249,870	453,587	311
December-14	1,179	2,874	88,918	88,067	2,179,705	361,608	332

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Average Demand per Customer: Class Coincident Peak							
Including Distribution Losses							
Hour Beginning	DS1	DS2	DS3	DS3S	DS4	DS4S	DS5
1/6/14 6:00 PM	3.1	6.3	149	80	3,414	164	0.7
2/11/14 8:00 AM	2.4	6.4	201	108	4,239	448	-
3/2/14 7:00 PM	2.6	4.9	136	58	3,435	374	0.7
4/14/14 8:00 PM	1.5	3.7	133	35	3,657	167	0.8
5/30/14 2:00 PM	1.5	5.9	179	30	4,405	527	-
6/19/14 4:00 PM	2.5	6.8	187	23	3,805	165	-
7/22/14 4:00 PM	2.6	5.7	182	23	3,757	291	-
8/25/14 3:00 PM	2.9	7.6	220	32	3,337	330	-
9/5/14 2:00 PM	2.4	6.9	218	38	3,726	345	-
10/1/14 7:00 PM	1.5	4.6	154	113	3,463	574	0.8
11/17/14 6:00 PM	2.1	4.7	159	177	3,603	540	0.8
12/1/14 6:00 PM	2.1	4.2	151	123	3,409	485	0.7

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Schedule E-7(b)(3)(D): Load Research												
Average Demand per Customer: Class Non-Coincident Peak												
Including Distribution Losses												
Hour Beginning	DS1	Hour Beginning	DS2	Hour Beginning	DS3	Hour Beginning	DS3S	Hour Beginning	DS4	Hour Beginning	DS4S	DS5
1/6/14 5:00 PM	3.1	1/23/14 10:00 AM	7.1	1/28/14 8:00 AM	192.6	1/22/14 9:00 AM	70.4	1/23/14 7:00 AM	3,842.7	1/22/14 1:00 PM	852.4	0.7
2/11/14 6:00 AM	2.7	2/7/14 10:00 AM	6.7	2/11/14 8:00 AM	201.0	2/4/14 8:00 AM	58.0	2/13/14 8:00 AM	3,869.4	2/4/14 11:00 AM	673.0	0.7
3/9/14 2:00 AM	3.1	3/3/14 10:00 AM	6.1	3/3/14 8:00 AM	183.6	3/24/14 10:00 AM	58.9	3/18/14 8:00 AM	3,740.2	3/10/14 3:00 PM	712.9	0.7
4/14/14 7:00 PM	1.7	4/3/14 10:00 AM	5.1	4/28/14 1:00 PM	172.8	4/15/14 10:00 AM	53.0	4/29/14 10:00 AM	3,842.9	4/15/14 10:00 AM	693.4	0.8
5/26/14 1:00 PM	2.2	5/28/14 11:00 AM	6.5	5/21/14 1:00 PM	191.9	5/1/14 10:00 AM	36.0	5/21/14 1:00 PM	4,020.5	5/6/14 10:00 AM	568.4	0.8
6/18/14 5:00 PM	2.6	6/19/14 1:00 PM	7.3	6/18/14 1:00 PM	204.0	6/23/14 11:00 AM	23.8	6/26/14 8:00 AM	3,834.5	6/4/14 1:00 PM	540.7	0.7
7/12/14 3:00 PM	2.7	7/22/14 11:00 AM	6.6	7/7/14 1:00 PM	197.8	7/3/14 11:00 AM	24.7	7/23/14 10:00 AM	3,761.8	7/7/14 9:00 AM	520.8	0.7
8/24/14 4:00 PM	3.2	8/25/14 3:00 PM	7.6	8/25/14 1:00 PM	226.4	8/4/14 1:00 PM	21.7	8/26/14 1:00 PM	3,695.0	8/29/14 11:00 AM	634.2	0.7
9/4/14 5:00 PM	2.6	9/4/14 1:00 PM	7.3	9/5/14 1:00 PM	218.1	9/26/14 2:00 PM	95.2	9/3/14 10:00 AM	3,806.3	9/27/14 5:00 PM	1,022.7	0.7
10/31/14 5:00 PM	1.6	10/1/14 12:00 PM	5.8	10/1/14 2:00 PM	188.9	10/20/14 4:00 PM	135.1	10/1/14 1:00 PM	3,548.7	10/21/14 10:00 AM	1,146.7	0.8
11/18/14 6:00 PM	2.1	11/18/14 10:00 AM	5.7	11/18/14 8:00 AM	188.8	11/1/14 2:00 PM	136.6	11/19/14 10:00 AM	3,668.7	10/31/14 12:00 PM	1,082.4	0.8
12/31/14 5:00 PM	2.3	12/17/14 10:00 AM	5.5	12/1/14 9:00 AM	179.0	12/4/14 10:00 AM	84.4	12/11/14 8:00 AM	3,418.8	12/10/14 9:00 AM	653.0	0.7